Development and validation of a measurement scale for self-efficacy for farmers' mastitis prevention in dairy cows

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ABSTRACT

The purpose of this study was twofold. First, we developed and validated the domain-specific Mastitis Prevention Self-Efficacy scale (MPSES), derived from developing a corresponding scale for the General Self-Efficacy Scale and consisting of 10 items describing dairy farmers' feelings of confidence about being able to prevent, reduce and control mastitis, a common infection of the udder. Second, farmers' cognitive assessment of mastitis was used in order to explore the correlation of general and domain-specific self-efficacy. The MPSES was completed by a sample of Swedish fulltime dairy farmers (n=290) through an online questionnaire. The instrument was found to possess good reliability (Cronbach's alpha α=.90) and correlated well with the S-GSE (*r* .62). Medium effects was identified by a correlation between the MPSES and farmers' cognitive assessment of time-line (r=0.3, p<0.001), and small effects for cure/control (r=.12, p<0.05) as well as for aspects related to cause (r=.17-.28, p<0.001) of mastitis. The potential usefulness of this scale in the dairy industry is discussed.

Keywords: self-efficacy, mastitis prevention, farmer behaviour, illness perception, animal welfare, animal health

INTRODUCTION

Self-efficacy is the concept widely used to explain the individual's self-evaluation of their perceived ability to successfully execute, or, perceived control over, a certain situation or behaviour to reach a desired outcome (Bandura, 1977, 1982, 1986; Wood & Bandura 1989). The concept itself is not considered stable as it can fluctuate over time and be situation-specific (Maddux et al., 1982; Luszczynska et al., 2005) which is explained by its multidimensionality (Zimmerman, 2000). Existing work has examined self-efficacy in terms of general self-efficacy (Sherer et al., 1982, Schwarzer et al., 1995; Luszczynska et al., 2005; Azizli et al. 2015) as well as related to a wide set of specific domains including occupation, learning, stress, health, social roles and/or role-specific self-efficacy (Hobfoll, 2002; Meier et al., 2008; Osborn et al. 2010; Rubino et al., 2012).

Domain-specific efficacy has been suggested as being a strong behavioural predictor and most suitable when analysing specific behaviour (Bandura & Wessels, 1997, Bandura, 1986; Pajares, 1996), whereas others have suggested that, when measuring self-efficacy in a more general sense, it refers to a broad and stable concept (e.g. Sherer et al. 1982). Studies have reported high predictability when using domain-specific self-efficacy measures, whereas, for general self-efficacy, similar result could not be identified (Bandura & Wessels, 1997, Bandura, 1986; Ferrari & Parker, 1992; Lindley & Borgen, 2002; Pajares, 1996). Overall, general self-efficacy is considered to measure a motivational trait, which is a more stable and permanent perception of one's own future performance, whereas domain-specific self-efficacy measures a motivational state, a momentary perception which may be changed as a reaction to internal and/or external triggers (e.g., Gardner & Pierce, 1998).

In this study, we focus on farmers' self-efficacy in relation to mastitis prevention. Keeping the prevalence of mastitis low is important for a number of reasons. Mastitis is one of the most common and most costly diseases in dairy cows and is, therefore, an economic burden on the

farmers (Hogeveen et al., 2011). It is caused by an infection in the cow's udder and causes pain and suffering to the animal, meaning that it also impairs animal welfare. Mastitis is also problematic as it is the predominant reason for antibiotic use in dairy farming (Teuber, 2001; SOU, 2014). It also impairs the quality of the milk, causing it to be less useful in the food value chain (Hogeveen et al., 2011).

In the context of self-efficacy and illness, perceived self-efficacy can refer to the belief that one can establish control of health problems by learning about key aspects of care (Bandura, 1991; Holman & Lorig, 1992). A person's perception of an illness has been suggested to be more strongly correlated with health outcome than with actual severity (Jones et al., 2014; Rosenstock, 1966). This can be explained by the self-regulatory model (Leventhal, Diefenbach, & Leventhal 1992; Leventhal et al., 1997) which suggests that individual responses to perceived illness are based on situational stimuli (such as symptoms) which lead to cognitive and emotional representations being generated as a reaction. This may take place in a three-step process in which the individual first forms the representation of the illness (in our case: farmers' perceptions of mastitis in their dairy herd), followed by them adopting coping behaviours (adoption of preventive measures), and lastly, appraising the efficacy of these behaviours (the perception of them having control of the situation). Studies have found, for both individuals and caregivers, that having a better understanding of an illness and a high self-efficacy are positively related to better compliance to treatment – and also improved health (Zelber-Sagi et al., 2017; Griva et al., 2000). As farmers are the foremost caregivers of dairy cows and responsible for taking necessary actions in order to ensure good animal health and welfare, it can be expected that similarities may be found to previous literature on caregivers in human illnesses.

The main objective of this study was to develop and validate the Mastitis Prevention Self-Efficacy Scale (MPSES) for the dairy farmer population with the aim of measuring domain-

specific self-efficacy in relation to mastitis prevention. At this time, no study has yet investigated domain-specific self-efficacy in the farming population.

MATERIAL AND METHODS

Theoretical framework and approach

Self-efficacy refers to individuals' beliefs concerning their ability to meet desired outcomes in life. Initially, self-efficacy referred to the individual perception of capabilities in certain domains (Bandura & Wessels 1997; Pajares 1996). Self-efficacy thus is a behaviour specific psychological feature that can be learned and enhanced (Bandura, 1986; Lorig et al., 1993).

Self-efficacy theoretically originates from Bandura's Social Cognitive Theory (SCT; Bandura 1986), which suggests that humans are able to exercise self-motivation and control in order to monitor their behaviour. According to theory, self-efficacy is believed to influence behaviours and environments and in turn to be affected by them (Bandura 1986; Bandura & Wessels, 1997) – meaning that a person's self-efficacy can be a direct result of their previous experience or beliefs. As self-efficacy is specific to context and actual behaviour it is believed to change over time based on human cognition, motivation, and behaviour (Bandura, 1997). When studying self-efficacy in students, Ouweneel et al. (2013) found that changes in self-efficacy were mainly due to engagement rather than actual performance. This was partly explained by the fact that self-efficacy can vary over time.

Given that farmers are continuously working to prevent mastitis in their dairy herd, they regularly obtain feedback on their performance (Bandura, 1997) through their exposure to the task and use of preventive strategies. This would suggest that domain-specific self-efficacy is more predictive than general self-efficacy in targeting farmers' perception of future beliefs in performing a specific behaviour related to mastitis preventions.

Self-efficacy is considered to influence how individuals reason, experience emotions, and incentivize themselves (Bandura & Wessels, 1997). Bandura and Wessels (1997) argued that, in order to ensure proper assessment of self-efficacy, measurement should be targeted at the actual domain of functioning rather than being measured on a general level. This means that scale items should be directly related to the construct that is being measured (Bandura 2006). Over the years, self-efficacy has been studied using a wide-range of methodological and analytical approaches (Bandura & Locke 2003). While acknowledging Bandura's arguments on the predictive power of domain-specific self-efficacy measures, others reason that measuring generalized self-efficacy is beneficial for explaining behaviour in less specific contexts (Schwarzer & Jerusalem, 1995: Sherer et al. 1982). Nonetheless, no amount of self-efficacy, irrespective of whether it is general or domain-specific, will produce a competent performance when the individuals lack the skills needed to succeed (Schunk 1995). Overall, research has consistently shown that efficacy beliefs contribute significantly to the level of motivation and performance of behaviour, as it can influence the choices people make and the courses of action they pursue (Bandura & Locke 2003). Individuals tend to select tasks and activities at which they feel competent and confident and avoid those at which they do not (Bandura & Wessles 1997), as individuals will only be motivated when they possess the necessary skills and incentives (Bandura, 1986).

To develop the Mastitis Prevention Self-Efficacy Scale (MPSES) , we used a two step-procedure: First, we developed and validated a domain-specific questionnaire measure MPSES, using the Swedish version of the validated measure General Self-efficacy scale, GSE (Schwarzer et al., 1995; Löve et al., 2012). Second, we compared the domain-specific measure MPSES with S-GSE with respect to its ability to explain farmers' cognitive assessment/representation of mastitis as an illness, measured through aspects such as cause, cure control, consequence and time-line of mastitis.

Questionnaire and sample

The study is based a data collection, performed on a random sample of Swedish full-time farmers specializing in dairy production. The data collection was completed as an online questionnaire study in the period April–June 2016.

All Swedish full-time farmers specializing in dairy production at the end of 2015 were eligible for the study. At the end of 2015 the total population of Swedish dairy farmers were 4039. Names, phone numbers, and addresses of a random sample of specialist dairy farmers were obtained from a register of all Swedish farmers administered by Statistics Sweden (Örebro, Sweden).

The survey was conducted by a third party specializing in survey data collection (IPSOS Sweden, Stockholm) on behalf of the research group, and the research group obtained anonymized data from the completed questionnaires.

An invitation letter containing the aims and objectives of the project was sent to respondents together with a link to the online questionnaire. In total, 1,200 farmers were invited to participate. Participating farmers were also given the option of completing the questionnaire offline instead of completing the online version, thereby avoiding unintentionally leaving out farmers with limited access to computers (n=42). Out of the sample of 1,200 farmers to which the questionnaire was sent, 143 persons refused to participate due to time constraints, 42 refused to participate due to other reasons, 40 no longer matched the target group (either they had retired or sold their dairy cows for other reasons), 3 declined participation due to illness, and 62 of the phone numbers were faulty (farmers where reminded about the questionnaire through phone by IPSOS). Prior to sending out the questionnaire, power estimations were performed based on the total population of Swedish dairy farmers with a margin of error of 5%

and a confidence interval of 95% expecting a response rate of 30%. According to our estimation we needed a total sample of at least 351 participants to be able to draw any statistical conclusions. To ensure that the sample was big enough IPSOS Sweden reminded farmers about the questionnaire until that requirement was fulfilled leaving us with a total of 356 (32.4%) respondents. A comparison was made between the participating farmers based on the background variables age and herd size, of the average Swedish dairy farmer in 2015, to evaluate whether there were any reasons to assume that our sample differs from the whole population of Swedish dairy farmers. Data for this comparison was obtained from the Swedish Agriculture Statistical Yearbook (Jordbruksverket, 2015).

The questionnaire required 30–40 minutes to complete as it was part of a larger data collection, and as a token of appreciation after completing the questionnaire each participating farmer was sent two lottery tickets.

Post data collection additional data on heard health including bulk milk somatic cell count (BMSCC) was obtained and matched to the participants from the Swedish Dairy Association. Around 80% of all Swedish dairy farmers are associated with the Dairy Cow Recording Scheme from which information about BMSCC was obtained. As our sample consisted of a representative sample of all dairy farms in Sweden we were not able to match data for all participating farms. Due to this 48 farms where excluded as we were not able to match data on herd health, leaving us with a sample of 308 farms. A case and variable screening was performed prior to data analysis for the dataset. As part of the questionnaire being administered online, no missing data was found as the participants were unable to skip a question. Further screening controlled for unengaged responses identified 18 participants who were excluded from the data set as evidence showed that they responded in the same way for every item meaning that no standard deviation was identified. After the screening, the data set consisted of 290 participants.

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184 ***Scales and measures***

185 *General Self-Efficacy Scale (GSE)*

186 The General Self-Efficacy scale (GSE; Schwarzer et al., 1995) is comprised of ten items that
187 require individuals to rate the extent to which they agree with statements on a 4-point scale (1
188 = Not true at all, 4= Exactly true). Example items from this measure are, "I can always manage
189 to solve difficult problems if I try hard enough" and, "I can remain calm when facing
190 difficulties because I can rely on my coping abilities." Previous studies have reported
191 Cronbach's reliability coefficients for the GSE ranging from .75 to .91 when comparing studies
192 from 25 different countries (Scholz et al., 2002). For the present study, the Swedish version
193 was used, S-GSE (Löve et al., 2012) (see Table 2 for all items used in this study).

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195 *Mastitis Prevention Self-Efficacy Scale (MPSES)*

196 The MPSES was derived from developing a corresponding scale to the S-GSE and consisted
197 of 10 items describing dairy farmers' feelings of confidence about being able to prevent
198 mastitis, reducing the incidence and controlling the situation on the farm. Example items from
199 this measure are, "If problems arise in my herd and my dairy cows suffer from mastitis, I can
200 always manage to find an appropriate measure if I try hard enough," and, "Thanks to my
201 resourcefulness, I know how to handle even surprising situations related to mastitis that can
202 occur in my herd." (see Table 2 with all items which were used to test perceived self-efficacy
203 in mastitis prevention together with the items of the S-GSE). Each of the statements were rated
204 on a 4-point scale (1 = Not true at all, 4= Exactly true).

205

206 *Mastitis Illness Perception Questionnaire (M-IPQ)*

Questions related to farmers' cognitive assessment of mastitis as a production illness were assessed using corresponding questions to the Illness Perception Questionnaire (IPQ; Weinman et al., 1996) a scale commonly used to assess cognitive representation of an illness in human medicine. The M-IPQ consisted of a total of 15 items, each item of the M-IPQ was constructed based on the IPQ and reformulated to fit the farmer population and match conditions common for mastitis in dairy herds. The original IPQ provide a rapid assessment of illness perception; the purpose of reformulating the questions to fit the aim of this study was to develop a new scale so as to enable assessment of farmers' perception of mastitis as a production illness. All items were rated on a 5-point Likert scale from "disagree completely" to "agree completely" (see Appendix 1 for all questions used). A principal axis factor analysis (PFA) was performed to explore the dimensionality of the measure in order to evaluate whether the same factors as those of the IPQ could be identified. Items with loadings greater than 0.4 were interpreted as representing a particular factor. The content of the four factors, as defined by these item loadings, provided confirmation of the theoretically derived factors related to consequence, time-line, cause and cure-control. One exception to the criteria was the item "Mastitis in an individual cow will pass quickly" which has a loading of 0.339 to the factor timeline (see Appendix 1 for factor loadings and Cronbach alpha for each subscale). When using the scale for the correlation analysis, three of the factors – time-line, consequences and cure-control were obtained by adding all the scales items together and dividing by the number of items. For the fourth scale, cause, it is recommended to handle each item separately as they each represent a specific causal belief (Weinman et al., 1996).

Statistical methods

We first used PFA in order to validate the developed domain-specific self-efficacy scale, MPSES, in comparison to the general S-GSE. Second, we explored whether the domain

specific measure MPSES in comparison to the S-GSE was a better explanatory measure for farmers' cognitive assessment/representation of mastitis as a production illness, measured through aspects such as cause, cure control, consequence and timeline of mastitis using Spearman correlation.

To examine the dimensionality of the MPSES in comparison to the S-GSE, PFA was conducted using PROMAX rotation. PROMAX was chosen, as it allows for cross correlation between the variables. A visual examination of a scree plot was used to determine the number of factors to retain for the MPSES. To investigate internal consistency, inter-item correlations, Cronbach's alpha and corrected item-total correlation were calculated for the MPSES for the total sample. Convergent validity was examined by calculating the correlation between MPSES and the S-GSE.

Questions corresponding to the Illness Perception Questionnaire (IPQ: Weinman et al., 1996) were developed to target farmers' cognitive assessment of mastitis in their dairy cows, constituting the Mastitis Illness Perception Questionnaire (M-IPQ). PFA, using the same settings as above, was used to identify whether the scale consisted of the four factors related to i) consequence, ii) time-line, iii) cause and iv) cure control (as identified in the original IPQ scale). In order to compare MPSES with S-GSE with respect to its ability to explain M-IPQ, farmers' cognitive representation, Spearman correlation was performed. For the correlation analysis farmers' subjective evaluation of the BMSCC at the herd, measures of actual BMSCC, herd size and milking system was included in the analysis as they are believed to have an effect on how the farmer works with preventing mastitis. Milking system included as three separate binary variables representing pipeline, parlor and automatic milking systems. All estimations were run using SPSS version 24 (SPSS, IBM Corp., IBM SPSS Statistics for Windows, Version 24.0, Armonk, NY, USA).

RESULTS

Descriptive statistics on the sample of farmers participating in the first questionnaire is presented in Table 1. Based on the sample used for the present study, the participating farmers are slightly older than the average farmer in 2015 and hold more dairy cows than average.

Internal consistency reliability was high for both the S-GSE scale (α = .88) and the MPSES scale (α =.90). Table 3 shows the factor loadings for the MPSES scale. Principle factor analysis of the MPSES scale supported a unidimensional structure with eigenvalue=5.40 for the first factor accounting for 54% of the total MPSES item variance. In contrast, analysis reveals that the GSE scale was two-dimensional, accounting for 59.6% of the total item variance.

In order to test the internal consistency of the MPSES, the corrected item-total correlations of the total sample ranged from .28 to .65. Item-total correlations did not indicate improvement or impairment for the removal of any of the items (part of the instruments) for the entire sample. Communalities ranged from .39 to .59. According to Kaiser's criterion and a visual examination of the scree plot, only one factor was retained in the factor analyses for MPSES (see Table 3 for details of factor loadings for MPSES). Convergent validity was examined by calculating the correlations between S-GSE and MPSES. For the total sample, the correlations between S-GSE and MPSES were r = .62, $p<0.001$ (See Table 4 for descriptive statistics and inter correlations for the MPSES and S-GSE together with variables used for exploratory purpose).

In order to compare the domain specific measure MPSES with the S-GSE in respect to its ability to explain farmers' cognitive assessment/representation of mastitis as a production illness, questions from the M-IPQ were used. As a first step, the factor structure of M-IPQ was explored using PFA based on which four items where dropped, leaving a total of 11 items being

used for the present study which loaded on four factors. The four items where dropped due to low loading on all identified four factors (see Appendix 1). For the Spearman correlation analysis, three factors i) consequence, ii) time-line, iii) cure control were used, for the items corresponding to cause, the items were used individually.

Results of the Spearman correlation (see Table 5 for results) indicated that there was a small effect with weak but significantly positive correlation between MPSES and cure control ($r=0.12$, $p<0.05$), between MPSES and two of the three items related to cause (r ranging from .17-.28, $p<0.001$) and a medium effect between MPSES and timeline ($r=0.32$, $p<0.001$), but not for consequence ($r=-0.03$, $p=0.58$) (Field, 2009). For S-GSE the results of the Spearman correlation indicated that there was a significantly and positive but weak association between S-GSE and timeline ($r=.20$, $p<0.001$) and between S-GSE and two of the items related to cause (r ranging from .18-.26, $p<0.001$).

DISCUSSION

This study developed a scale for domain-specific self-efficacy in mastitis prevention, MPSES, and evaluated it in relation to general self-efficacy, S-GSE, in the Swedish dairy farming population. The study is based on responses from a set of 290 dairy farmers. Compared with the average Swedish dairy farmer in 2015, the respondents were older and had larger dairy herds, which may imply that our results are representative especially for farmers who possibly are more experienced and where the dairy production is of greater economic significance. We found both measures, MPSES and S-GSE, to be internally consistent ($\alpha=.90$ and $\alpha=.88$ respectively). PFA performed for the two instruments revealed the MPSES scale to be unidimensional whereas the GSE scale consisted of two dimensions. Analyses comparing the domain specific instrument with the general instrument S-GSE suggest that they are highly correlated. The dimensionality of the S-GSE has previously been discussed, as some

researchers have suggested that it is unidimensional (Löve et al., 2012 (Swedish version), Scholz et al., 2002) and others have suggested that it is multidimensional (Bosscher & Smit, 1998; Chen et al., 2001; Woodruff & Cashman, 1993). The theoretical assumptions that self-efficacy can fluctuate over time and be situation specific supports the suggestion that the construct consist of multiple dimensions (Zimmerman, 2000), as does the fact that the general measure explains self-efficacy in a non-specific situation. In a domain-specific scale, however, we argue that unidimensionality is plausible as it is related to self-efficacy in a specific situation. By using the General Self-efficacy Scale (GSE; Schwarzer et al., 1995), and developing corresponding questions related to self-efficacy in mastitis prevention (described as MPSES), our expectation is that the domain-specific measure developed here will be valuable in understanding farmers' perceptions of being able to handle the situation on the farm related to the preventive work regarding mastitis.

The results of this study indicate that both general and domain-specific self-efficacy is weakly correlated with farmers' assessment of the items corresponding to cause. These results indicate that farmers' perceptions of their self-efficacy can, both on a general as well as domain-specific level, partly explain the variation of the assessment of mastitis as an illness. In general, our result may point to MPSES and the S-GSE being measures which cover different types of domain, as is suggested by the way in which the two measures are phrased. The domain-specific scale intended to capture farmers' self- efficacy in relation to mastitis specifically corresponds to more of the domains of the M-IPQ measure than the general scale. The findings are mainly explained by the items comprising farmers' cognitive assessment of being able to understand its cause. For cure control these factors were only related to the domain-specific scale suggesting that farmer's perception of self-efficacy in mastitis prevention is a predictor among farmers. Considering the factor for cure control, items such as "My actions will not affect the outcome of mastitis in my herd" (see Appendix

1 for all items) suggest that farmers who perceives a high self-efficacy also rate themselves as more able to cure and control the situation. Moreover, the aspects related to time-line ("Mastitis among my cows will only be a short-term problem, which will then disappear completely" and "Mastitis among my cows will probably be a permanent rather than a temporary problem") together suggest an understanding of the illness as a continuum, rather than a feeling of being able to control the situation. This could be considered in relation to previous studies suggesting that having a better understanding of an illness and high self-efficacy are positively related to better compliance with treatment – and also improved health (Zelber-Sagi et al., 2017; Griva et al., 2000). The items related to cure-control and consequences have previously shown a higher test-retest reliability than the scale related to Time-line in humans (Weinman et al., 1996) This was argued to be a result from people suffering from an illness perceiving the consequences and cure of their illness to be less likely to change over time, which may have more serious consequences. Related to time-line, results have shown that having a higher score means that the individual perceives it as less likely that the illness is controllable or curable, leading to severe personal consequences (Weinman et al., 1996). However, our results suggest that neither the MPSES, nor the S-GSE are strong predictors of farmers' perceptions of the consequence of mastitis, as indicated by small and medium effects identified by the correlation coefficients (Field 2009). Neither one of the self-efficacy scales was correlated with the factor related to perceived consequence of dairy cows having mastitis, consisting of the items "cows in my herd suffering from mastitis is a serious condition" and "my cows suffering from mastitis causes serious consequences for their well-being". This can be explained by the fact that neither one of the items comprise areas in which farmers have the possibility to act.

In relation to other psychological concepts, such as Theory of Planned Behavior (Ajzen & Fishbein 1975), self-efficacy is considered as one of the most important precondition for

behavioral change, since it determines the individuals' initiation of coping behavior and perception of his or her own capabilities. This may be compared to perceived behavioral control, which is part of the Theory of planned behavior, which rather explains an individuals' actual ability to perform a behavior. Measuring self-efficacy is an easy way to explain how well an individual perceives him or herself able to cope with a certain situation and may therefore be a more appropriate instrument in measuring and screening possible differences in farmers adoption of strategies in order to control diseases in the own herd.

As self-efficacy is a changeable psychological state rather than a permanent personality trait (Ouweneel et al., 2013), one would expect some variation in the responses over time within individuals. Although the present results indicate that the MPSES on its own may be a predictor of farmers assessment of mastitis as an illness as well as a perception of their possibility to act preventively, more research is needed where individuals are followed over time to study whether farmers' self-efficacy can be improved.

Mastitis in dairy production is problematic due to its adverse effects on farm financial results, the usefulness of milk in the food value chain (Hogeveen et al., 2011), animal welfare and antibiotic use (Teuber, 2001). Reducing the prevalence of mastitis is thus important from a business point-of-view, both for the farm businesses and the dairy plant processors. It is also important from a societal perspective as poor animal welfare can in itself be considered a negative externality in animal production but most of all it is bad for the animals.
Furthermore, reducing the use of antibiotics in animal production would be one important step in reducing the risk of antibiotic resistance and leakage of medical residue into the water supply. MPSES, as developed in this study, is expected to be useful in agricultural sectors, both for practicing veterinarians as well as for research, as this scale can provide a rapid assessment of farmers' perceptions of being able to perform a specific behaviour for illness prevention as well as providing insights into farmer's behaviour in relation to mastitis

prevention both in Sweden and internationally. This would allow for the development of targeted efforts in order to improve animal health, which will have positive consequences for farm profitability, animal welfare, the avoidance of antibiotics use and the usefulness of the milk in the food value chain. The ultimate goal with the instrument is that it can be used by veterinarians and other animal health advisors in their efforts to assist farmers in reducing the prevalence of mastitis in their herds. The MPSES may also be used internationally after certain adaption to fit the target group and its specific situation regarding animal health. In particular, MPSES can be used as an instrument to screen farmers' self-efficacy in relation to mastitis prevention in dairy cows. This can be used as a basis for providing more individually adjusted advice to different farmers. This is supported by previous studies showing positive effects by training and increasing the own expectancy of self-efficacy on actual performance accomplishment where individuals who received more training prior to performing the actual behavior had a higher success rate (Holloway & Watson 2002). In particular, this will be useful for identifying those farmers with relatively low levels of MPSES, who are likely candidates for more thorough advice in order to improve their feelings of capacity to affect mastitis prevalence in their herds. In this way, veterinarians and other animal health advisors will be able to better prioritize their time and other resources among different farmers depending on their level of MPSES. MPSES is also a likely candidate to explain differences in farmers' uptake of different types of mastitis prevention measures in their herds. Consequently, this study provides support for the MPSES being used as a self-efficacy measure for dairy farming population behaviour related to animal health that can be useful in future research aiming at explaining such uptake as well as in advisory services.

CONCLUSION

In conclusion, our findings suggest that the MPSES scale may help to assess motivation and performance in farmers' work in preventing mastitis. In particular, MPSES enables an easy and accessible way of quickly measuring farmer's beliefs in their ability to act (illness prevention) in the future.

Conflict of interest statement

None of the authors have any financial or personal relationships that would inappropriately influence the findings in this study.

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